**Business Use Cases Solved Case Study**

**1. Real-Time Flight Operations Monitoring**

* **Problem**: Airlines need live updates on flight delays, cancellations, and telemetry anomalies.
* **Solution**:
  + Telemetry streams into Event Hub → Silver (DV2) → Gold fact tables.
  + Power BI dashboards provide *near real-time flight performance metrics* (on-time %, average delay, cancellation rate).
* **Value**: Improves operational efficiency & decision-making (e.g., rerouting, scheduling crews).

**2. Predictive Maintenance**

* **Problem**: Aircraft failures cause costly delays and safety risks.
* **Solution**:
  + Telemetry data (engine temp, pressure, speed, fuel flow) analyzed in Databricks ML.
  + Detect anomalies (engine overheating, abnormal fuel consumption).
  + Predict maintenance before failures occur.
* **Value**: Reduces unplanned downtime, lowers maintenance costs, improves safety.

**3. Passenger Experience & Loyalty Insights**

* **Problem**: Low passenger satisfaction due to cancellations, poor seat utilization, inconsistent loyalty programs.
* **Solution**:
  + Booking + passenger data analyzed in Gold layer.
  + Loyalty tier change history, booking trends, cancellations analyzed.
  + Predict churn → targeted retention offers.
* **Value**: Higher customer satisfaction, improved loyalty program ROI.

**4. Crew Scheduling & Efficiency**

* **Problem**: Crew allocation is often inefficient (under/over utilization, compliance with duty hours).
* **Solution**:
  + Silver DV2 captures crew assignments & flight logs.
  + Gold dashboards track crew utilization, shift overlaps, compliance.
* **Value**: Better workforce management, reduced overtime costs, compliance with aviation regulations.

**5. Delay Cause Analysis (Weather vs Maintenance vs Crew)**

* **Problem**: Airlines struggle to pinpoint exact reasons for delays.
* **Solution**:
  + Gold star schema joins weather, crew, and telemetry data with flight schedules.
  + Dashboards show breakdown: % delays due to weather, % due to maintenance, % due to crew.
* **Value**: Enables root-cause analysis → improves planning & on-time performance.

**6. Regulatory Compliance & Data Governance**

* **Problem**: GDPR, FAA/EASA regulations require strict data privacy & auditability.
* **Solution**:
  + PII masked in Bronze/Silver, only anonymized values in Gold.
  + Data Vault lineage tracks every record’s origin (record\_source, load\_dt).
  + Purview enables PII tagging & audit reporting.
* **Value**: Reduces compliance risk, enables safe data sharing with regulators.

**7. Revenue & Cost Optimization**

* **Problem**: Airlines need to maximize revenue per route and minimize operational costs.
* **Solution**:
  + Gold fact tables capture seat utilization, ticket sales, fuel efficiency.
  + Power BI dashboards highlight profitable vs unprofitable routes.
* **Value**: Informed decision-making for route planning, fuel savings, better pricing strategies.